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CCS related research activities in 3E (Energy, Environment and Economy Research Institute), Tsinghua Univ.

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Tsinghua University
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Outline

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- **CCS related research projects**
  - **EU FP6 project -- Geocapacity**
  - **EU FP6 project -- COACH**
  - **Sino-UK cooperation -- NZEC**
  - **Sino-US cooperation**
- **Progress of these projects**

EU FP6 project -- GeoCapacity

GeoCapacity

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Partic. Number	Participant Name	Participant Short name	Country
1	Geological Survey of Denmark and Greenland	GEUS	Denmark
2	University of Sofia	US	Bulgaria
3	University of Zagreb	RGN	Croatia
4	Czech Geological Survey	CGS	Czech Republic
5	Institute of Geology at Tallinn University of Technology	IGTUT	Estonia
6	Bureau de Recherce de Geologie et Miniere	BRGM	France
7	Institute Francaise du Petrole	IFP	France
8	Bundesanstalt für Geologie und Rohstoffen	BGR	Germany
9	Institute for Geology and Mining Engineering	IGME	Greece
10	Eötvös Loránd Geophysical Institute of Hungary	ELGI	Hungary
11	Isituto Nazionale Oceanografie e Geofisica Sperimentale	OGS	Italy
12	Latvian Environment, Geology & Meteorology Agency	LEGMA	Latvia
13	Institute of Geology and Geography	IGG	Lithuania
14	Geological Survey of the Netherlands	TNO-NITG	Netherlands
15	Ecofys	Ecofys	Netherlands
16	Academy of Science (MEERI)	MEERI	Poland
17	Geophysical Exploration Company	PBG	Poland
18	GeoEcoMar	GeoEcoMar	Romania
19	Dionyz Stur State Geological Institute	SGUDS	Slovakia
20	GEOINZENIRING	GEO-INZ	Slovenia
21	Instituto Geologico y Minero de Espana	IGME	Spain
22	British Geological Survey	BGS	UK
23	EniTecnologie (Industry Partner)	ENI	Italy
24	ENDESA Generacion (Industry Partner)	Endesa	Spain
25	Vattenfall AB (Industry Partner)	VAB	Sweden/Poland
26	**Tsinghau University**	**TU**	**P. R. CHINA**

GeoCapacity

Work Package 1
Inventory of major CO2 emission points
Lead : BGS

- **WP 1.1** Emissions Inventory of major CO2 emission point sources for all countries. Also input for pipelines, topography, LNG terminals, gas storeages, HC fields, Case Studies. Participants: input from all
- **WP 1.2** GIS mapping of new input and inclusion of exisisting data (GESTCO, IEA GHG). Participants: BGS, GEUS
- **WP 1.3** EU maps of emissions and geological storage potential. Participants: GEUS, BGS, All

Work Package 2
Geo-capacities in aquifers, geothermal & other reservoirs
Lead : GEUS

- **WP 2.1** North East Group : Estonia, Latvia, Lithuania, Poland, Czech R., Slovakia. Lead : SGUDS Slovakia
- **WP 2.2** Central East Group : Romania, Bulgaria, Hungary, (Albania & FYROM). Lead : ELGI Hungary
- **WP 2.3** South Group : Spain, Italy, Slovenia, Croatia. Lead : U. Zagreb Croatia
- Regional geol. storage assessments
- Country storage capacity calculations
- **WP 2.4** Case studies (2-3 per country). Lead : TNO with IFP
- **WP 2.5** Country updates from previous study areas (Germany, Denmark, UK, Greece, Netherlands, France). Lead : BGR, Germany

Work Pack . 3
Economic use of CO2
Lead : IFP

- **WP 3.1** Geo-capacities in hydrocarbon structures and EOR potential. Lead : PBG Poland
- **WP 3.2** Geo-capacities in coal beds and ECBM potential. Lead : CGS Czech R.

Work Pack . 4
Standards, Site selection criteria
Lead : GEUS

- **WP 4.1** Site selection criteria. Lead : BGS
- **WP 4.2** Defining Geo-storage capacity standards. Lead : GEUS

Work Pack . 5
Economic Evaluation
Lead : TNO

- **WP 5.1** DSS development. Lead : TNO
- **WP 5.2** Economic evaluations. Lead : Ecofys

Work Pack . 6
Internat. Coop & Capacity Building
Lead : BRGM

- **WP 6.1** Establish framework for coop and initiate geo-storage technology transfer. Lead : BRGM
- **WP 6.2** Establish joint activities with CSLF member China as. Lead : GEUS

Work Pack . 7
Project Mgmt & Reporting
Lead : GEUS

- **WP 7.1** Overall project management (including non-personel budget). Lead : GEUS with CGS, ELGI, SGUDS
- **WP 7.1** Reporting to EU. & CSLF and conference papers. Make Website and CD. Lead : GEUS & CGS Czech R. (website) with OGS Italy

TU's tasks

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- **WP1: a region in China**
  - **Inventory of major carbon emission points for Hebei Province**
- **WP6: International cooperation and capacity building**
  - **Storage potentials assessment for Huabei oil field**
  - **Mapping of sources and sinks**

Power sector CO_2 Emission Sources in Hebei Province

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- **Totally around 130 thermal power plants with capacity over 6 MW**
- **There are 42 power plants with capacity over 50 MW (all coal-fired power plants)**
- **Average operation hours: 6350 hours**
- **Average gross coal consumption rate: 350 gce/kWh**
- **Emissions from these 42 sources amount to 137 Mt CO2/yr**

Other CO_2 Emission Sources in Hebei Province

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Type	Total enterprises		Collected enterprises		
	Number	annual production	Number	annual production	CO_2 estimated (Mt CO_2/yr)
Iron & Steel	9	24Mt	9	24Mt (100%)	47
Cement	386	88.5Mt	18	31.4Mt (35%)	25.4
Ammonia	50	3.3Mt	16	1.9 Mt (58%)	7.8
Oil refinery	3	9.4Mt	3	9.4Mt (100%)	3.3

CO_2 Emission Sources in Hebei Province

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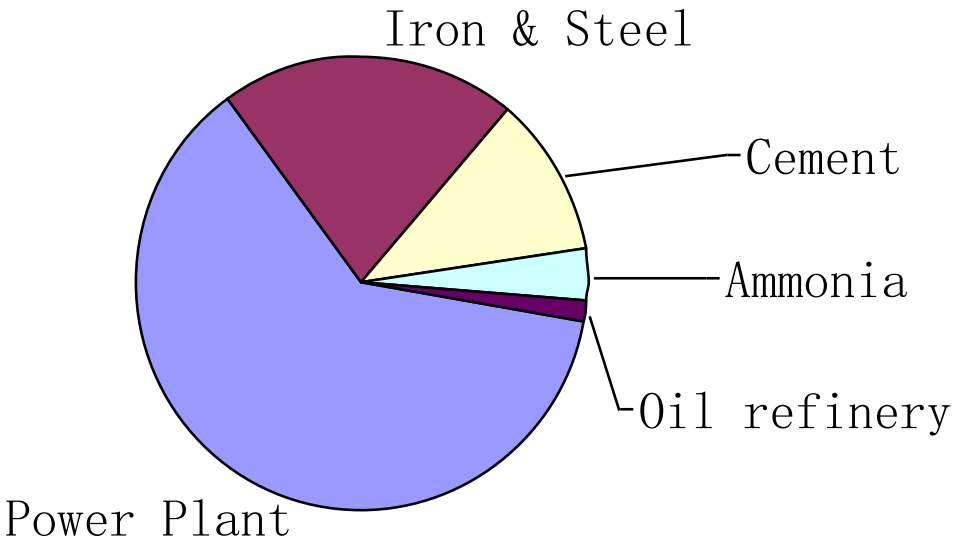

88 emission sources
220Mt CO2/yr

Distribution of CO2 sources

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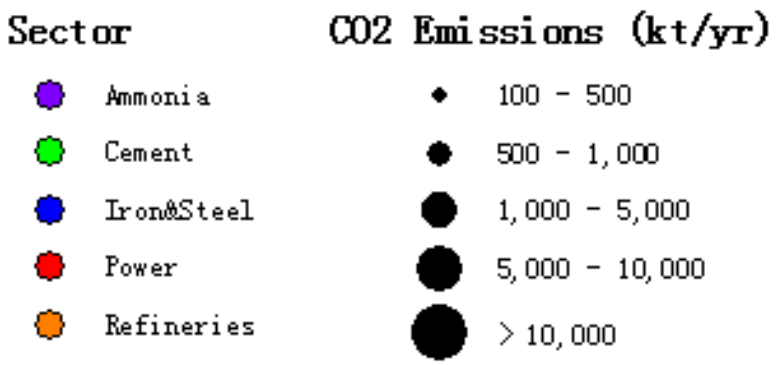
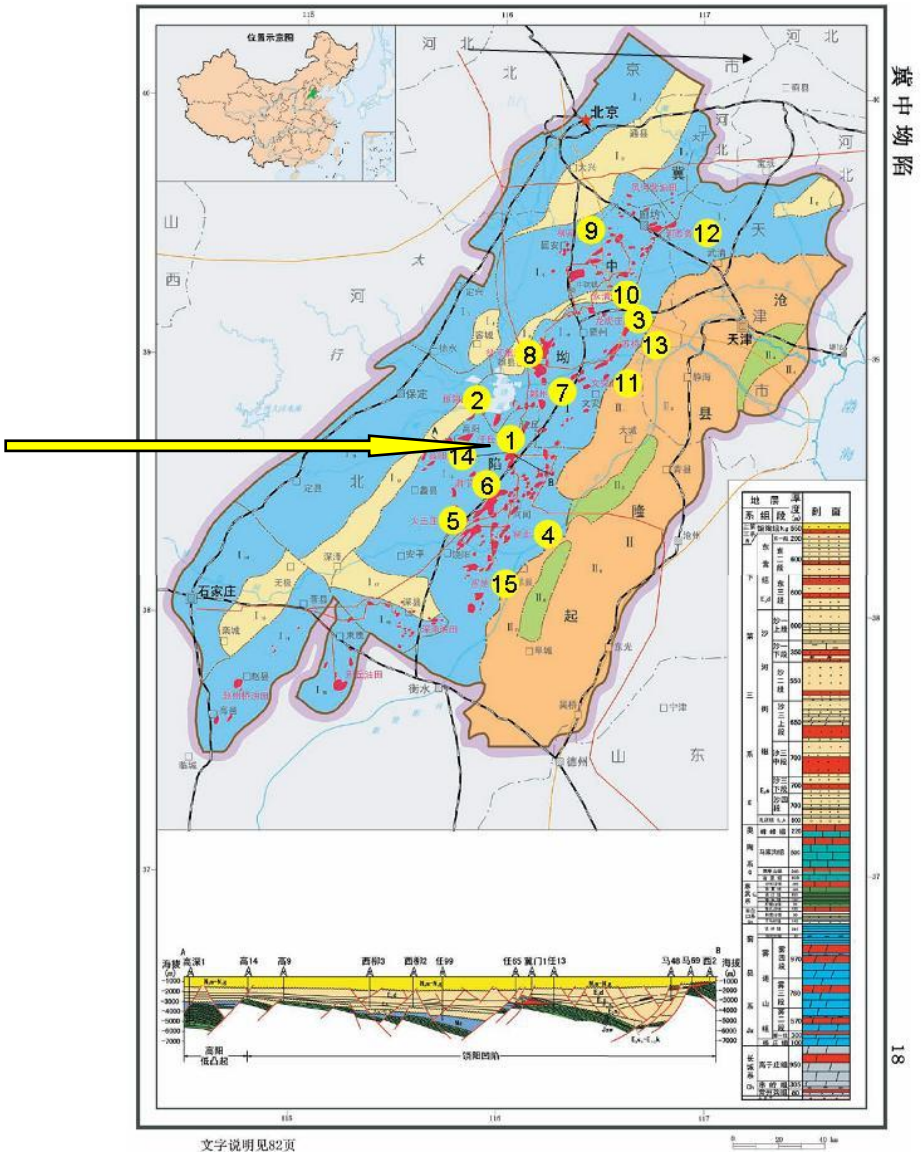


Jizhong Depression

- 43 oil & gas fields in Jizhong Depression including 23 buried hill oil fields and some tertiary oil fields.
- Renqiu Oilfield: buried hill oil fields with larger thickness (average 272m) but lower porosity (3%-5%).
- The proven OOIP of Renqiu oilfield is 406 Mt oil and 2.3 billion m^3 gas.
- Hydrocarbon field storage potential: 600MtCO2



Aquifer areas in Jizhong depression

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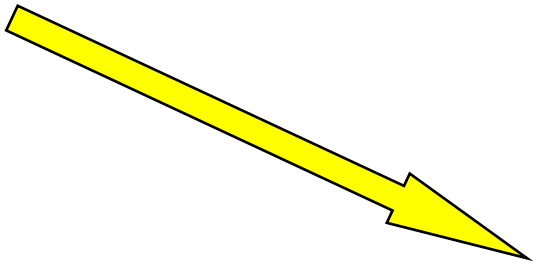

Aquifer storage potential: 3500MtCO2

Sinks: GIS present results

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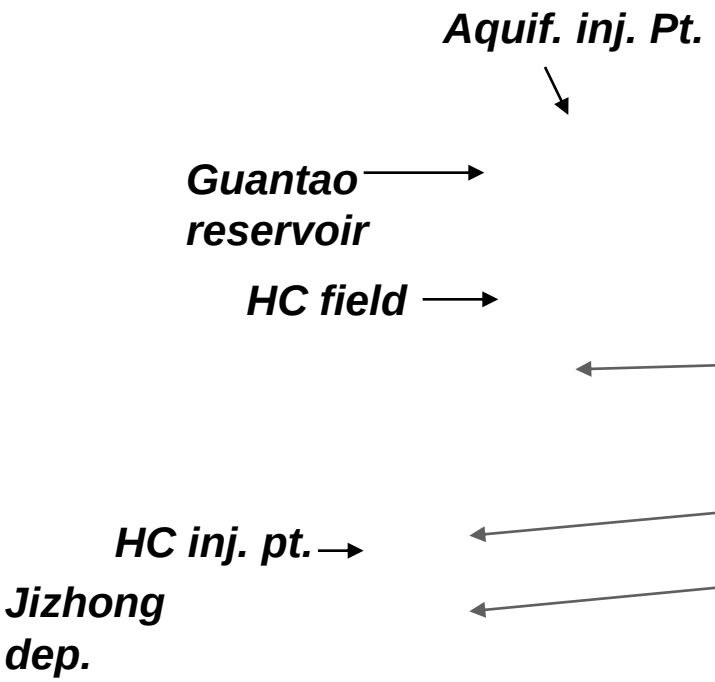

- **Map displaying:**
  - The Jizhong depression
  - The Guantao aquifer
  - The HC fields
  - The injection points in aquifer and in HC fields
  - A schematic representation of the main pipeline routes

EU FP6 project -- COACH
(Cooperation Action within CCS China-EU)

COACH

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Partic. n°	Participant name	Participant short name	Country
1	Institut Français du Pétrole	IFP	FR
2	SINTEF Energiforskning AS	SINTEF-ER	NO
3	Geological Survey of Denmark and Greenland	GEUS	DK
4	Natural Environment Research Council - British Geological Survey	BGS	UK
5	Kungliga Tekniska Högskolan	KTH	SE
6	BP International Ltd.	BP	UK
7	STATOIL ASA	Statoil	NO
8	Shell China Exploration and Production Co. Ltd	Shell	CHN
9	Etudes et Productions Schlumberger	EPS	FR
10	ALSTOM Power Ltd	ALSTOM	UK
11	Air Liquide	AIR-L	FR
12	Atanor	Atanor	FR
13	**The Administrative Centre for China's Agenda**	**ACCA21**	**CHN**
14	**Tsinghua University**	**TU**	**CHN**
15	**Zhejiang University**	**ZJU**	**CHN**
16	**Institute of Engineering Thermophysics, Chinese Academy of Sciences**	**IET**	**CHN**
17	**Thermal Power Research Institute**	**TPRI**	**CHN**
18	**Institute of Geology and Geophysics, Chinese Academy of Sciences**	**IGGCAS**	**CHN**
19	**Research Institute of Petroleum Exploration&Development-Langfang, PetroChina**	**RIPED**	**CHN**
20	**China Huaneng Group**	**CHNG**	**CHN**

COACH

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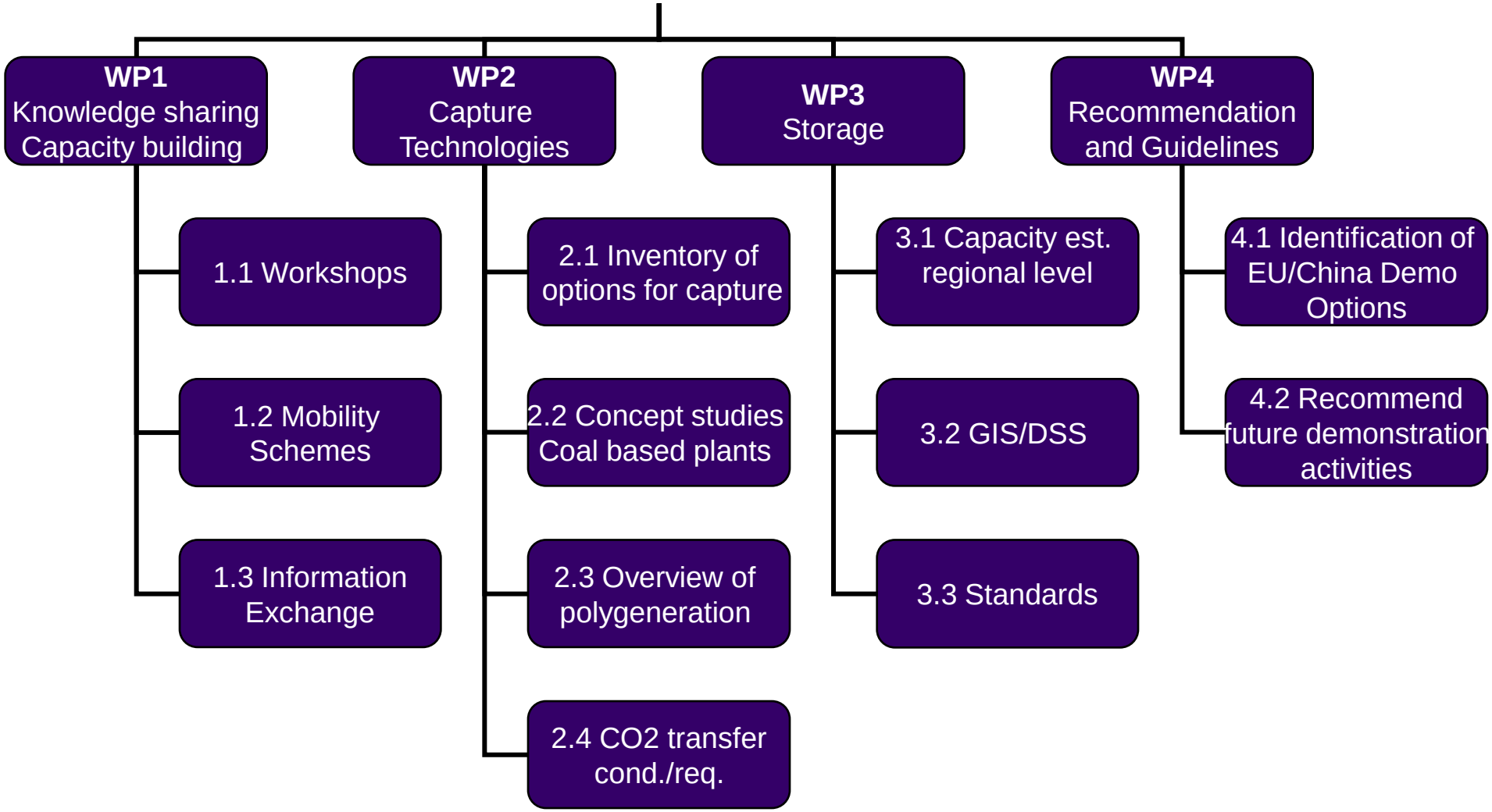

Power Plant CO_2 Emission sources in Shandong province

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- **Totally around 170 thermal power plants with capacity over 6 MW**

- **There are 49 power plants with capacity over 100 MW**
  - 1 gas power plant
  - 1 oil power plant
  - 47 coal-fired power plants

- **Average operation hours: 5010 hours**

- **Average gross coal consumption rate: 330 gce/kWh**

- **Emissions from these 49 sources amount to 120 MtCO2/yr**

CO_2 sources in Shandong Province

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49 Power Plants with capacity over 100 MW in Shandong, 120Mt CO2

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Sino-UK cooperation
-- Near Zero Emissions Coal (NZEC) Initiative

NZEC

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- **Defra/DTI and MOST envisage an ambitious phased approach over several years for the development, funding and implementation of the NZEC project**

Phase 1	**Exploring the Options for Near-Zero Emissions Coal in China – Assessment**	**2006-2009**
Phase 2	**Define, Plan and Design a Demonstration Project**	**2009-2011**
Phase 3	**Construct and Operate a Demonstration Project**	**2011-2014+**

Work Packages for Phase 1

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- **WP1: Knowledge Sharing and Capacity Building**
- **WP2: Future Energy Technology Perspectives**
- **WP3: Case Studies for Carbon Dioxide Capture**
- **WP4: Carbon Dioxide Storage Potential**
- **WP5: Policy level recommendations for demonstration and roadmap for deployment of CCS for coal fired power generation**

Sino-US cooperation

Power sector CO_2 Emission Sources in Henan Province

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- **Totally around 160 thermal power plants with capacity over 6 MW**
- **There are 60 power plants with capacity over 100 MW (all coal-fired power plants)**
- **Average operation hours: 5500 hours**
- **Average gross coal consumption rate: 410 gce/kWh**
- **Emissions from these 60 sources amount to 110 Mt CO2/yr**

CO_2 sources in Henan Province

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60 Power Plants with capacity over 100 MW in Henan, 110Mt CO2

CO2 sources in Hebei, Shandong and Henan

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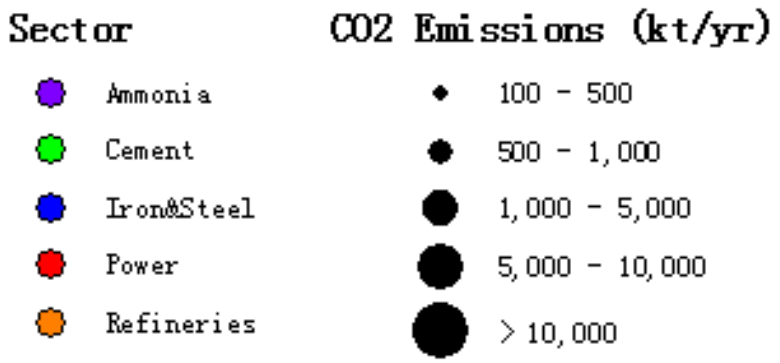

Thanks